TP 14271E

Flight Data Monitoring Demonstration Project

Phase 3

Prepared for
Transportation Development Centre
of
Transport Canada

by

WESTJET

June 2004

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by

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Since some of the accepted measures in the industry are imperial, metric measurements are not always used in this report.

Un sommaire français se trouve avant la table des matières.

105-03511/

Transport Canada / Transports Canada

PUBLICATION DATA FORM

1 Transport Canada Publication No.	2 Project No.	3 Recipient's Catalogue No.
TP 14271E	5227	

4 Title and Subtitle	5 Publication Date
Flight Data Monitoring Demonstration Project: Phase 3	June 2004
	6 Performing Organization Document No.

7 Author(s)	8 Transport Canada File No.
Mike Plottel	2450-BP1

9 Performing Organization Name and Address	10 PWGSC File No.
WestJet Airlines Limited 35 McTavish Pl Northeast Calgary, Alberta Canada T0M 1B0	XSB-1-01155
	11 PWGSC or Transport Canada Contract No.
	T8200-011552/001/XSB

12 Sponsoring Agency Name and Address	13 Type of Publication and Period Covered
Transportation Development Centre (TDC) 800 René Lévesque Blvd. West Suite 600 Montreal, Quebec H3B 1X9	Final
	14 Project Officer
	H. Posluns

15 Supplementary Notes (Funding programs, titles of related publications, etc.)

Co-sponsored by Transport Canada's Civil Aviation Directorate and by the Program of Energy Research and Development of Natural Resources Canada.

16 Abstract

This report covers the final phase of a three-phase flight data monitoring (FDM) demonstration project jointly undertaken by WestJet and the Transportation Development Centre of Transport Canada. The project objectives were to enhance the safety and efficiency of flight operations at WestJet and throughout the national air transportation system through implementation of an FDM program at the airline and through joint promotion of FDM programs with other Canadian carriers.

The project ran from March 2002 to June 2004. During this period, WestJet developed and implemented its FDM plan, policies, and procedures. Data analysis and flight animation software were selected and installed on a secure network set-up for the FDM program. An Event Review Team was established and WestJet flight data analysis trials in May 2003. Full-scale FDM operations commenced in January 2004.

This Phase 3 report describes the final phases of FDM implementation as well as certain aspects of regular FDM operations. Topics covered include a description of WestJet's flight animation system, an event set review, FDM communication plan developments, Gatekeeper training and activities, system upgrades, and future applications. Phase 1 and 2 reports are included as appendices.

17 Key Words	18 Distribution Statement
Flight data monitoring, FDM, demonstration project, flight data analysis trials, WestJet	Limited number of copies available from the Transportation Development Centre

19 Security Classification (of this publication)	20 Security Classification (of this page)	21 Declassification (date)	22 No. of Pages	23 Price
Unclassified	Unclassified	—	xiv, 12, apps	Shipping/ Handling

Transports Canada Transport Canada

FORMULE DE DONNÉES POUR PUBLICATION

1. N° de la publication de Transports Canada	2. N° de l'étude	3. N° de catalogue du destinataire
TP 14271E	5227	

4. Titre et sous-titre	5. Date de la publication
Flight Data Monitoring Demonstration Project: Phase 3	Juin 2004
	6. N° de document de l'organisme exécutant

7. Auteur(s)	8. N° de dossier - Transports Canada
Mike Plottel	2450-BP1

9. Nom et adresse de l'organisme exécutant	10. N° de dossier - TPSGC
WestJet Airlines Limited 35 McTavish Pl Northeast Calgary, Alberta Canada T0M 1B0	XSB-1-01155
	11. N° de contrat - TPSGC ou Transports Canada
	T8200-011552/001/XSB

12. Nom et adresse de l'organisme parrain	13. Genre de publication et période visée
Centre de développement des transports (CDT) 800, boul. René-Lévesque Ouest Bureau 600 Montréal (Québec) H3B 1X9	Final
	14. Agent de projet
	H. Posluns

15. Remarques additionnelles (programmes de financement, titres de publications connexes, etc.)

Coparrainé par la Direction générale de l'Aviation civile de Transports Canada et le Programme de recherche et développement énergétiques de Ressources naturelles Canada

16. Résumé

Le présent rapport rend compte de la troisième et dernière phase d'un projet de démonstration de suivi des données de vol (SDV) réalisé par WestJet, en collaboration avec le Centre de développement des transports de Transports Canada. Ce projet visait à accroître la sûreté et l'efficacité des opérations aériennes de WestJet et de l'ensemble du système national de transport aérien par la mise en œuvre d'un programme de suivi des données de vol chez le transporteur aérien, et par la promotion conjointe des programmes SDV auprès des autres compagnies aériennes du Canada.

Le projet s'est déroulé entre mars 2002 et juin 2004. Au cours de cette période, WestJet a élaboré et mis en œuvre son plan, ses politiques et ses procédures SDV. Les logiciels d'analyse des données et d'animation de vol ont été choisis, puis installés sur un réseau protégé spécialement conçu pour le programme SDV. Une équipe chargée de l'examen des événements (ECEE) a été créée et WestJet a procédé à des essais d'analyse des données de vol en mai 2003. Le programme SDV est devenu entièrement opérationnel en janvier 2004.

Ce rapport de la phase 3 du projet fait le point sur les dernières étapes de la mise en œuvre du programme SDV et sur certains aspects du fonctionnement normal du système. On y retrouve notamment une description du système d'animation de vol de WestJet, l'examen d'un ensemble d'événements; sont aussi abordés les travaux sur les plans de communications relatifs au programme SDV, la formation et le rôle des contrôleurs, les mises à niveau du système et ses applications futures. Les rapports des phases 1 et 2 du projet se trouvent en annexe.

17. Mots clés	18. Diffusion
Suivi des données de vol, SDV, projet de démonstration, essais d'analyse des données de vol, WestJet	Le Centre de développement des transports dispose d'un nombre limité d'exemplaires.

19. Classification de sécurité (de cette publication)	20. Classification de sécurité (de cette page)	21. Déclassification (date)	22. Nombre de pages	23. Prix
Non classifiée	Non classifiée	—	xiv, 12, ann.	Port et manutention

ACKNOWLEDGEMENTS

The cooperation and support of Howard Posluns, Chief of Advanced Technology for the Transportation Development Centre of Transport Canada, and Tom Dunn, Program Manager of Quality Assurance and Flight Data Monitoring for the Civil Aviation Directorate of Transport Canada, in facilitating this project are gratefully acknowledged.

EXECUTIVE SUMMARY

This project was initiated in May 2001, when WestJet and the Transportation Development Centre (TDC) of Transport Canada first discussed the concept of a Flight Data Monitoring (FDM) demonstration project. The project was formalized in January 2002, with a memorandum of understanding between WestJet and Transport Canada's Civil Aviation Directorate, and in March 2002, with the signing of a formal agreement to conduct the demonstration project. Under the agreement, Civil Aviation would provide partial funding for development and implementation of an FDM program at WestJet in exchange for progress reports on FDM successes and challenges. The agreement also provided for WestJet to support TDC and Civil Aviation in promoting FDM programs with other Canadian carriers.

Phases 1 and 2 of the project involved preparatory work for the FDM program, including developing an FDM plan, conducting a user needs assessment, selecting data analysis software, installing a secure FDM network, developing FDM policies and procedures, collecting an initial data set from operational flights, and producing trial data analysis reports.

Phase 3 of the project involved the selection and installation of flight animation software, the transition to regular FDM program operations, and initiation of Gatekeeper-pilot contacts. The Insight flight animation package produced by Flightscape, Inc. of Ottawa, Ontario, was selected and installed in June 2003. Insight is used by the FDM program to provide Event Review Team (ERT) members with an intuitive picture of events of interest for confidential debriefing of flight crews, and by the Flight Safety Office for incident investigation. Basic animations, not involving detailed runway environments, can be produced from raw or processed flight data in approximately 10 minutes.

Transition from the FDM trial phase to regular operations in January 2004, was relatively seamless. An ERT meeting schedule was established and a basic FDM report package was produced for each meeting. Gatekeeper roles with respect to data review and pilot contacts were formalized. All Gatekeepers underwent an in-house training program covering software applications and interview techniques before commencing pilot contacts.

The WestJet FDM program also featured several forward-looking aspects. The FDM communication plan, targeted at major FDM stakeholders, includes briefings, reports, an intranet web-based presentation, and a planned FDM open house. Wireless aircraft-to-ground data downloads are being investigated for possible implementation in 2005. Finally, expanded applications are being considered, such as incorporating high-resolution satellite photography in animations for airport familiarization training, integrating FDM into a safety management system, and correlating FDM reports with line oriented safety audit observations.

SOMMAIRE

Ce projet a été lancé en mai 2001, moment où WestJet et le Centre de développement des transports (CDT) de Transports Canada ont discuté pour la première fois de l'idée d'un projet de démonstration du suivi des données de vol (SDV). Le projet a été officialisé en janvier 2002 par un protocole d'entente entre WestJet et la Direction générale de l'Aviation civile de Transports Canada, et en mars 2002, par la signature d'un accord formel prévoyant la réalisation du projet de démonstration. En vertu de cet accord, la Direction générale de l'Aviation civile allait financer en partie l'élaboration et la mise en œuvre d'un programme SDV chez WestJet, en échange de rapports sur les succès du programme SDV et les problèmes rencontrés. L'entente prévoyait en outre que WestJet appuierait le CDT et la Direction générale de l'Aviation civile dans la promotion des programmes SDV auprès des autres transporteurs aériens du Canada.

Les phases 1 et 2 du projet ont consisté en des travaux préparatoires au lancement du programme SDV, soit : élaboration d'un plan de SDV, évaluation des besoins des utilisateurs, sélection d'un logiciel d'analyse des données, installation d'un réseau protégé pour le SDV, élaboration de procédures et de politiques relatives au SDV, collecte d'un ensemble de données initiales provenant de vols opérationnels et production de rapports d'analyse des données d'essai.

La phase 3 du projet a comporté la sélection et l'installation d'un logiciel d'animation de vol, la transition vers l'exploitation normale du programme SDV et le début des contacts entre les contrôleurs et les pilotes. Le progiciel d'animation de vol *Insight*, produit par Flightscape, Inc. d'Ottawa, Ontario, a été retenu et installé en juin 2003. *Insight* est utilisé par le programme SDV pour fournir aux membres de l'équipe chargée d'examiner les événements (ECEE) une image intuitive des événements jugés importants aux fins du débreffage confidentiel des membres d'équipage. Ce logiciel est également utilisé par le Bureau de la sécurité des vols à des fins d'enquête sur les accidents. Des animations de base, ne présentant pas de pistes d'atterrissage détaillées, peuvent être produites à partir de données de vol brutes ou traitées, en environ 10 minutes.

La transition entre la phase d'essai et la phase d'exploitation normale du programme SDV s'est faite de façon harmonieuse en janvier 2004. Un calendrier des réunions de l'ECEE a été élaboré et un dossier de base sur le programme SDV a été produit pour chacune des réunions. Le rôle des contrôleurs en ce qui concerne l'examen des données et les contacts avec les pilotes a été officialisé. Tous les contrôleurs ont suivi un programme de formation interne sur les applications logicielles et les techniques d'entrevue avant de commencer à contacter les pilotes.

Le programme SDV de WestJet comportait également plusieurs aspects prospectifs. Le plan de communications relatif au programme SDV destiné aux

principaux intéressés comprend des séances d'information, des rapports et une présentation sur l'Intranet, et prévoit également la tenue d'une journée porte ouverte sur le suivi des données de vol. On étudie présentement la possibilité de mettre en œuvre la transmission des données des avions vers le sol dès 2005. Finalement, diverses applications élargies sont envisagées, comme l'intégration d'images satellitaires haute résolution dans les animations, aux fins de cours de familiarisation avec les aéroports, l'intégration du SDV aux systèmes de gestion de la sécurité, et la corrélation des SDV avec les observations faites dans le cadre des vérifications de sécurité visant les compagnies aériennes.

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GLOSSARY

AGS	Analysis Ground Station
ATC	Air Traffic Control
ERT	Event Review Team
FDAMS	Flight Data Acquisition and Management System
FDM	Flight Data Monitoring
FOQA	Flight Operations Quality Assurance
IFES	In-Flight Entertainment Systems
IMC	Instrument Meteorological Conditions
LOSA	Line Oriented Safety Audit
PCMCIA	Personal Computer Memory Card International Association
SMS	Safety Management System
TCAS	Traffic Alert and Collision Avoidance System
VMC	Visual Meteorological Conditions
WJPA	WestJet Pilots Association

1. Introduction

In the past year, WestJet has achieved several significant milestones in its Flight Data Monitoring (FDM) program, including:

- installation of a flight animation system;
- collection and analysis of over nine months of flight data;
- refinement of the exceedance event set;
- implementation of a flight crew communication plan;
- formalization of Event Review Team (ERT) activities;
- investigation of wireless data download options;
- development of Gatekeeper roles;
- development of pilot contact procedures;
- system upgrades; and
- planning for ongoing operations.

The FDM team collected and analysed flight data from a number of B737-700 aircraft during system trials conducted between June 2003, and December 2003. Beginning in January 2004, the FDM program went "live," collecting all available data, producing monthly reports, and conducting monthly ERT meetings. Ad hoc meetings with Flight Operations management and the Flight Operations training staff have also been held as and when required.

The WestJet Pilots Association (WJPA) has taken on a more active role in the program since the program went live in January. The association's executive has taken an active role, along with the Flight Safety and Flight Operations departments, in developing Gatekeeper roles and pilot contact procedures, and has posted an FDM PowerPoint presentation on its flight crew web site. The association's safety representative has attended ERT meetings and is working with the FDM Program Manager and the Gatekeepers on ongoing FDM operations.

WestJet's FDM program has become an important component of the company's Safety Management System by helping to proactively identify operational risks and to evaluate the effectiveness of operational risk management activities.

2. Flight Animation System

WestJet's decision to acquire a flight animation system as an integral component of the FDM program was first identified in our FDM Plan, published in September 2001. The flight animation system is seen as a valuable tool in event analysis, flight safety investigations, and stakeholder communication programs. This resource permits the ERT to undertake rapid and intuitive analyses of selected

events by bringing multiple data streams together in the animation of aircraft flight path, flight attitudes, and flight instruments.

WestJet has purchased the Insight flight animation system produced by Ottawa-based Flightscape, Inc. Insight was first installed at WestJet in June 2003, and has since undergone several software upgrades. Flightscape has provided excellent service in developing accurate flight instrument and power quadrant displays for WestJet's animations. To facilitate this process, Flightscape's software developer was provided access to company training pilots, a B737-700 full flight simulator, and several B737-700 aircraft. The result has been an exceptional degree of fidelity in the program's representation of the:

- primary flight display;
- multifunction display;
- mode control panel;
- flight mode annunciator; and
- power quadrant.

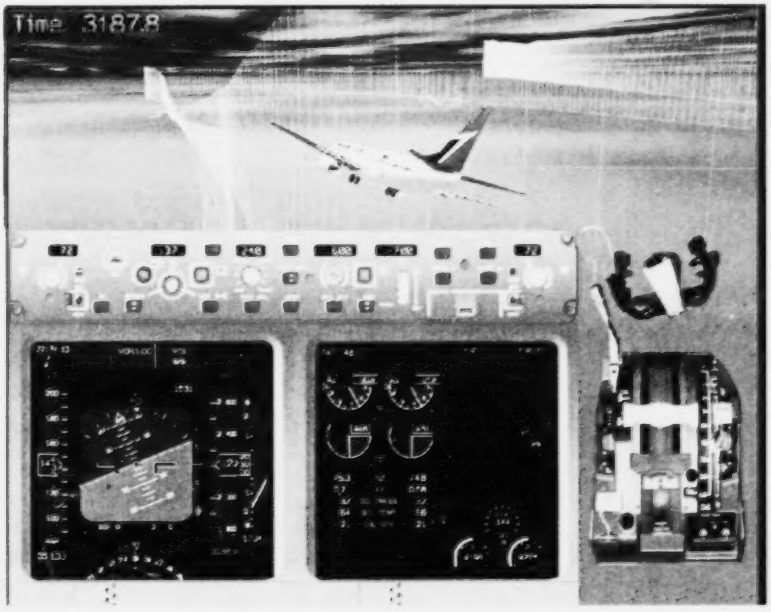

Figure 1 – Insight Flight Instrument and Visual Displays

WestJet's two FDM workstations were originally configured in 2002 with one 120 GB drive each, partitioned into C and D drives for the Insight and AGS (data analysis) systems, respectively. After installation of the basic Insight system in 2003, it became apparent that the partitioned C drive space was not adequate to accommodate the terrain database and satellite imagery for use in Insight

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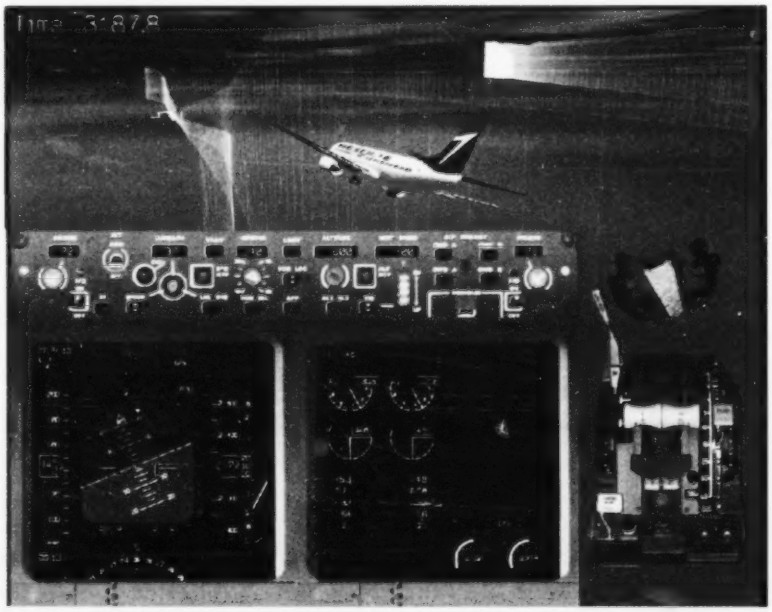

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animations. Both workstations were upgraded to two 120 GB drives in March 2004, and plans are currently under way to load terrain and imagery data.

The hard drive upgrade will provide WestJet with the capability to produce high-fidelity airport environments in its animations. Terrain and airport visualization can be important when analyzing an event that occurred close to the ground, in flight safety investigations, and in FDM presentations.

Another key application being developed by WestJet is the use of Insight for pilot airport familiarization training. Insight's capability to establish a virtual camera position anywhere in the animation environment will permit us to create airport familiarization animations highlighting procedures, terrain, and airport characteristics from a number of useful visual perspectives. This resource will be particularly useful for familiarizing pilots with foreign charter destinations, where unique procedures or terrain exist, and where flights may be conducted during hours of darkness.

3. Flight Data Collection and Analysis

Flight data is captured on removable PCMCIA (Personal Computer Memory Card International Association) cards by the B737-700's flight data acquisition and management system (FDAMS). This state-of-the-art system provides very reliable data, with few drop-outs or corrupted data sets. WestJet's Maintenance department cycles the cards out of the aircraft on a weekly basis and copies them to a secure server for input to the FDM system.

The PCMCIA cards are currently capturing data from approximately 70 percent of flights. An upcoming FDAMS modification will resolve this issue, and provide 100 percent coverage before the end of 2004.

Flight data is retrieved automatically from the secure Maintenance server and processed daily by the FDM analyst. We are currently working to automate data processing in order to free up additional work time for the FDM analyst.

Once the data are processed, exceedance events are reviewed by the Gatekeepers and the Program Manager. Gatekeepers are allocated 3½ person-days per month to review events and flights, and ½ person-day per month to attend the monthly ERT meetings. Either the Gatekeepers or the Program Manager can validate or invalidate recorded events, based on analysis of a range of recorded flight parameters. WestJet's ground data analysis system permits the user to access flight data directly from exceedance event reports.

Following the event validation process, the FDM analyst produces a series of statistical and "drill-down" reports for distribution to the ERT, Flight Operations management, and WestJet flight crews. Seventeen monthly FDM reports are routinely produced, including:

Statistical Reports	*Drill-down Reports (histograms)*
Events by Class (1, 2 or 3)	Flap 1 Extension Speed
Ten Most Frequent Events	Final Flap Extension Height
All Events by Frequency	Maximum Pitch at Landing
Events by Flight Phase	

Flight data analysis conducted during the trial period in 2003 permitted the ERT to fine tune event triggers and parameters, and to establish a baseline for event frequencies. Several events were deleted and several added during this period (see Section 4).

4. Event Set Refinement

A number of event definitions were re-defined or refined, and several eliminated during the FDM trial period. For example, the programming for Event 1318 (Autopilot Engaged Below 50 ft.) was revised in December to preclude a false trigger when flight crews conduct an auto-landing procedure. An auto-landing requires both autopilot channels to be engaged to touchdown and roll-out, therefore the event was re-written to suppress false triggers under this condition.

Several new events were also added during the trial period. For example, Traffic alert and Collision Avoidance System (TCAS) events were originally programmed by AGS supplier SFIM Inc. to indicate a "Climb" or "Descend" advisory. The ERT determined that more detailed TCAS Resolution Advisory (RA) reporting would be beneficial, and tasked the FDM analyst with expanding this portion of the event set. The FDM analyst worked with WestJet's avionics department and with Boeing staff to identify 11 specific TCAS messages as individual events. These new events will enable the Flight Operations training staff to analyse typical flight crew responses to TCAS advisories, and identify any opportunities for improving pilot training programs.

Two new events monitoring taxi techniques were also added. A taxi speed event for straight line taxiing, with a trigger limit of 30 kn was created first. Next, an event to monitor taxiing turns was created, with a speed limit trigger of 25 kn. and a lateral G trigger limit of 0.15 G.

The WestJet event set will continue to evolve as the program matures and requirements change. Regular event set amendment periods will be observed and event change dates will be recorded in order to facilitate effective data analysis.

5. FDM Communication Plan

In January 2004, the WestJet FDM communication plan began shifting its focus from one of introducing the program to one providing ongoing feedback to critical stakeholders. While a certain amount of ongoing education will always be required (e.g., newly hired pilots, transitioning pilots, and corporate stakeholders), the task of disseminating performance statistics has taken on greater priority.

The three critical stakeholder groups requiring ongoing feedback are the flight crews, flight operations management, and the flight operations training group. Three primary strategies are being used to keep flight crews informed.

1) A self-playing PowerPoint presentation has been included on the WJPA website. Flight crews can access this presentation to learn more about the FDM program structure, processes, and procedures, and view sample outputs. Along with periodic pilot memos and handouts, this aspect of the communication plan serves to keep flight crews informed about FDM program basics.

2) More specific FDM results are presented to pilots during their initial and recurrent training sessions. The FDM Program Manager or a member of the Flight Safety Office addresses all initial and recurrent pilot groundschool classes, where an overview of FDM statistics is presented. Classroom and simulator training programs have also incorporated FDM findings when the flight operations training group has considered it appropriate.

3) FDM monthly reports are displayed on a secure bulletin board in the Calgary operations centre flight crew room. Current and historical trends are posted, along with analyses of recent events of interest.

In all of these forums, pilots are encouraged to contact any member of the ERT if they have questions or feedback about the program.

The Flight Operations management team and the Flight Operations Training and Standards department are kept informed via the monthly FDM reports, regular briefings, and ad hoc meetings to deal with specific FDM findings. The Training and Standards department is also kept up to date on an ongoing basis by their representative on the ERT.

Other FDM stakeholders include senior management and WestJet's Maintenance department. Senior management briefings are provided on an ad hoc basis and through quarterly Flight Safety reports to the Board of Directors. These reports do not require the level of detail provided to flight crews and Flight Operations managers, and so deal primarily with program developments.

The Maintenance department is kept up to date by their representatives on the ERT and through direct contact with the FDM Program Manager. FDM results have complemented output from WestJet's aircraft condition monitoring system, and the two systems have been used to identify and verify specific data anomalies caused by sensor or system faults.

An FDM "open house" is planned to provide a better understanding of FDM to all stakeholders and interested departments. The open house format will consist of a live presentation or the introductory PowerPoint presentation, live demonstrations of the FDM data analysis and animation resources, and a question and answer session.

Communication strategies will be further developed as the FDM program matures and as WestJet's Safety Management System communication plan is developed.

6. Event Review Team and Gatekeeper Scheduling

The ERT has established a regular schedule of monthly meetings as well as a standard meeting format. Gatekeepers are also tasked weekly to review FDM data and conduct pilot contacts.

The ERT meets the fourth Wednesday of each month to review and discuss program developments, review the previous month's statistics, and receive the Gatekeepers' report. This schedule permits adequate time for all of the previous month's data to be downloaded and processed, and for the Gatekeepers to complete their reviews and pilot contacts.

One Gatekeeper is assigned to an eight hour office day each week to review flights and conduct pilot contacts. A full review of one week's data currently requires an average of four hours. The remaining four hours of duty are used at the Gatekeeper's discretion throughout the week to conduct pilot contacts (if necessary) and to liaise with the other two Gatekeepers.

7. Pilot Contact Procedures

Gatekeeper-pilot contacts are required to validate events and ensure that FDM statistics are truly representative of event occurrence rates. Each pilot contact must meet the following criteria in order to be effective for the ERT, the Gatekeeper, and the pilot:

- pilot confidentiality must be assured;
- the environment and nature of the contact must be non-threatening;
- the contact process must be consistent; and

- the outcome must provide information not available from data analysis alone.

To ensure these criteria are consistently met, each of WestJet's three Gatekeepers will receive training in FDM interview techniques prior to conducting any pilot contacts. Subjects such as making initial contact, setting the tone for the interview, selecting time and location, effective listening, effective recording, and reporting techniques will be covered. Gatekeepers will also participate in a number of role-playing interview scenarios that will be evaluated by the instructor and by other ERT members. This training will be completed in early May 2004.

To maintain a level of consistency in Gatekeeper-pilot contacts, the ERT has developed a general interview format. Each interview must include:

- an introduction to the FDM program and the purpose of the interview;
- an opportunity for the pilot to recount the event and any contributing factors;
- specific questions (if necessary) to ascertain additional details of the event;
- specific questions (if necessary) to complete a standardized report (see below);
- an opportunity for the pilot to provide suggestions as to how a reoccurrence could be avoided; and
- an explanation of the FDM event follow-up process.

The ERT is also developing a standardized report for specific classes of events to help identify contributing factors that might be influenced to prevent reoccurrences. For example, for events that occur during final approach, Gatekeepers must ascertain whether the approach was conducted in visual or instrument meteorological conditions (VMC or IMC). If the approach was conducted under VMC, it is also important to know whether an instrument procedure was followed or whether a visual approach procedure was flown. Other relevant information would include which pilot was flying, specific weather conditions (such as turbulence or wind shear), and Air Traffic Control (ATC) clearances.

Gatekeepers will begin pilot contacts in May 2004. Contacts will initially be limited to events that occur during final approach, since statistics indicate this is the highest-risk phase of flight (reference Transportation Safety Board of Canada, U.S. National Transportation Safety Board and the Flight Safety Foundation). Gatekeeper-pilot contacts will be expanded to other FDM events as the program matures and resources permit.

8. Wireless Data Download Options

WestJet currently downloads flight data via PCMCIA cards, which record data from an onboard FDAMS. The solid-state FDAMS on Boeing's 737 NG aircraft are extremely reliable, and have consistently provided high-quality flight data.

One of WestJet's FDM challenges is to maintain an effective data download system as its FDM fleet grows from the current 28 aircraft to a potential of 94 by the end of 2008 (the 18 B737-200 aircraft currently operated by WestJet are not part of the FDM program). The logistics of cycling PCMCIA cards in and out of almost 100 aircraft can be very challenging; therefore, alternate data download technologies are being explored.

Preliminary concepts for three wireless data download systems have been reviewed by the FDM program. One system uses cell phone technology, but is not currently developed to the point of marketability. Challenges to this technology include data transmission rate and data security.

Another system currently being tested by several providers is a dedicated data download transmitter connected to the FDAMS, which communicates with its own ground network when the aircraft is parked. Equipment and usage costs have not yet been determined and will hinge on the volume of customers subscribing to each network. Again, data security issues must be addressed from both the data encryption perspective and a shared network perspective.

WestJet has also explored the concept of using the 737-700 in-flight entertainment system's (IFES) ground-based network to download flight data. The IFES currently uses wireless technology to communicate system status with its provider and to transfer data at selected ground stations. Unused capacity may be available to transmit flight data; however, specific details and pricing will not be known until later in 2004.

WestJet recognizes the potential cost savings and performance advantages of wireless download technology and will continue to investigate options as they become available. As a member of both the Canadian FDM users group and the US FOQA Demonstration Project, WestJet will have access to the latest supplier developments and to other carriers' wireless experience.

9. System Upgrades

Both the AGS (data analysis) and Insight (flight animation) software packages have undergone a number of improvements during the life of WestJet's FDM program. In order to fully utilize the expanding capability of both resources, the FDM network underwent several hardware and software upgrades in early 2004.

The FDM server was upgraded to the latest Dell operating patch in January. Both FDM workstations had a second 1.2 GB hard drive installed in March and were upgraded from Windows 2000 ® to Windows XP Professional ® in April.

Installation of the new drives will provide faster system response and permit the importing and overlay of topographical data and high resolution satellite imagery for flight animations. The Windows XP platform will provide better system performance and bring the FDM workstations in line with WestJet's desktop standard.

The importance of a well-qualified and committed IT support group cannot be overemphasized. FDM hardware requirements and software applications are unique and require IT support personnel to develop a high level of expertise in their configuration and operation. While FDM vendors are very good at providing support for their products, it is the in-house IT team that maintains the system and ensures ongoing reliability.

10. Ongoing Operations

WestJet has set several goals for ongoing FDM operations, including event set reviews, drill-down analyses, and annual program reviews. Event definitions and trigger limits are reviewed on an ongoing basis at ERT meetings. As the program gains operational experience, events are revised, added or deleted to best meet the program's objectives. Event changes are implemented on a batch basis whenever possible, as they often require reprocessing of large amounts of flight data to get historical or baseline results. Major stakeholders are advised when substantive changes are made to one or more events.

Drill-down analyses are also being undertaken on an expanding basis. Drill-down analyses are custom reports that provide FDM users with a more in-depth picture of specific operations than do normal statistical reports. For example, a drill-down report can provide information from thousands of flights on the speed distribution for flap extension (see Figure 2) or the altitude distribution for engine spool up. Drill-down analyses can also provide correlations between FDM events and other factors, such as flight phase or landing runway.

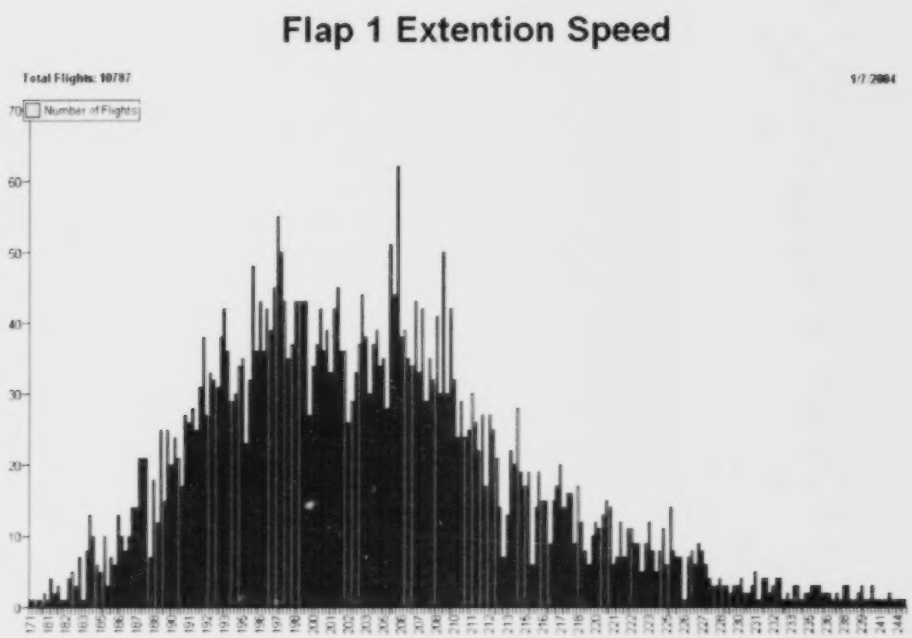

Figure 2 – Distribution of Frequency vs. Flap 1 Extension Airspeed

Annual reviews of the FDM program are planned. The first annual review is scheduled for January 2005, one year after commencing live operations. Annual reviews will be performed by a review committee of stakeholders in conjunction with the FDM Program Manager and the ERT, and will focus on program performance and setting new objectives for the coming year.

11. Future Applications

WestJet is planning a number of exciting applications for the FDM program, including airport familiarization, Safety Management System (SMS) integration, Line Oriented Safety Audit (LOSA) integration, and energy efficiency management.

With the recent system upgrades, Insight animations will be capable of including high-fidelity visual airport environments. These environments are created by overlaying topographical information and high-resolution satellite imagery onto the runway environment of a selected airport. Not only will this serve to produce high-quality animations of specific approach events, it will also provide the opportunity to use Insight as an airport familiarization tool for flight crews. WestJet anticipates creating its first high-quality airport familiarization animation by the summer of 2004, and has set a goal of producing 5 to 10 airport

familiarization animations and distributing them to flight crews by the end of 2004.

FDM will also become a major reporting node in WestJet's SMS. Risk assessments will be assigned to Class 3 events, with frequency statistics used in determining the probability of any specific event. Regular and ad hoc FDM reports will also be used in determining the effectiveness of risk management strategies implemented by the Flight Operations team.

WestJet is currently assessing the value of conducting a LOSA in 2005. LOSA places trained flight deck observers on a sample of line flights for the purpose of recording strengths and risk exposures in day-to-day operations. LOSA reports provide aggregate results about the environmental and human elements of an operator's risk management performance, and do not identify individual pilots or crews. WestJet hopes to correlate FDM statistics with the aggregate LOSA findings in order to obtain a comprehensive picture of its risk management performance.

FDM can also provide an extremely accurate picture of aircraft and fleet operating efficiency. Fuel consumption, engine power settings, aircraft attitude, flight profiles, configuration changes, and similar parameters can all be tracked in great detail. These parameters can be used to monitor and adjust operating procedures to maximize energy efficiency. For example, if an FDM report were to indicate that an aircraft was flying slightly out of trim, correcting the situation might save thousands of litres of fuel over a period of months. FDM can also provide feedback on actions taken to improve energy efficiency, through data analysis following implementation of new processes or procedures.

12. Conclusions

WestJet's FDM program has developed from a concept to a fully operational safety management resource in just 2½ years. It is Canada's only fully functional in-house program and operates on par with established FDM/FOQA programs in the United States and abroad.

This exceptional evolution would not have been possible without the commitment and support of WestJet's Executive, its Operations Management group, the WJPA, the FDM implementation team, the FDM program team, and others.

Another key element in the success of this program has been the support provided by Transport Canada's Civil Aviation Directorate, which has taken a cooperative and pragmatic approach to its FDM policy, encouraged FDM development at Canadian airlines, and provided resources to make FDM implementation a reality in Canada.

WestJet has been proud to be a partner in this program and looks forward to future collaborative projects that further enhance safety in the Canadian airline industry.

APPENDIX A

Joint Flight Data Monitoring Demonstration Project

Phase 1 Report

Prepared for
Transportation Development Centre
of
Transport Canada

by

WESTJET

July 2002

1. Introduction

Flight Data Management (FDM), also known as *Flight Operations Quality Assurance (FOQA)*, is the routine analysis of Flight Data Recorder or aircraft data bus parameters for the purpose of improving flight safety and operational efficiency. FDM has been in use by airlines in Europe for over 20 years and by airlines in the United States for the past 7 years. All airlines operating FDM programs have reported measurable gains in flight safety and significant savings in maintenance and operating costs.

WestJet has had an interest in FDM since the company began operations in 1996. As early as 1997, WestJet participated in ATAC and Transport Canada meetings on FDM programs and in 1998 WestJet attended the ISASI FDM workshop held in Ottawa. In 2000, WestJet was represented at the FAA's FOQA 2000 Symposium held in Irvine, California.

WestJet's current FDM initiative commenced in April of 2001 when discussions about an FDM demonstration project began with the *Transportation Development Centre (TDC)*, the research and development arm of Transport Canada. The TDC wished to pursue a demonstration project for the purposes of promoting FDM in Canada and furthering safety and efficiency within the air transportation system. WestJet wished to initiate an FDM program to enhance its flight safety efforts and to complement its flight operations, flight training and maintenance programs.

Those initial discussions led to this project, under which the TDC is providing financial and technical resources to WestJet in exchange for assistance in promoting the FDM concept in Canada. This report covers the first phase of WestJet's FDM program development including initial planning, user needs assessment, policy and procedure development, stakeholder education and *ground data replay & analysis software (GDRAS)* selection.

2. Early Planning

WestJet's first step was to establish an *FDM Steering Committee* for the purpose of coordinating FDM efforts between departments and providing high level guidance in the development of the FDM program. The Steering Committee was first constituted in June of 2001 and consisted of representatives from the Flight Safety, Flight Operations, Legal and Maintenance departments, as well as members of WestJet's executive and its pilots association. The Steering Committee met several times over the following months to discuss high level issues such as program scope, objectives, management, costs, benefits and liabilities.

At a meeting between the Steering Committee, the TDC and *Transport Canada Civil Aviation (TCCA)* in July of 2001, the TDC presented its concept of the FDM demonstration project. Issues surrounding each party's participation in the project, as well as TCCA's commitment not to use FDM information for enforcement actions, were discussed. It was agreed that a memorandum of understanding (MOU) specifying each party's obligations would be drafted and signed before proceeding with the joint project

In September, the Steering Committee reached an agreement with WestJet's pilots association for representation under the MOU and for participation in the FDM program.

The Steering Committee also identified ten significant issues to be addressed in the MOU and provided them to the TDC. Issues such as data ownership, enforcement actions, reporting and funding were discussed over the next several months. An MOU between WestJet and TCCA to proceed with the FDM demonstration project was signed on January 24, 2002.

3. User Needs Assessment

As part of WestJet's FDM planning, a user needs assessment was carried out to determine what current and future benefits FDM could provide to various operational departments. Direct benefits to the Flight Safety, Flight Operations and Flight Training departments were immediately identified, including:

- identifying and quantifying operating trends;
- identifying opportunities to improve flight operations; and
- providing feedback for training programs.

The Maintenance and Dispatch departments were slower to identify potential FDM benefits but did conclude that information on fuel consumption, operating trends and other flight parameters would be useful in enhancing their operations.

The user needs assessment was conducted in two parts. The first phase consisted of a departmental survey carried out by the FDM Program Manager (WestJet's Flight Safety Officer). Management interviews were then conducted by a consultant retained as part of WestJet's GDRAS selection process. The two surveys complemented each other and provided a good picture of WestJet's needs and expectations for its FDM program.

4. The FDM Plan

WestJet began writing its FDM Plan in December of 2001 in anticipation of proceeding with an FDM program, regardless of the outcome of negotiations with the TDC. The FDM Plan is WestJet's overall blueprint for development and implementation of the FDM program and includes:

- FDM goals and objectives;
- program organization;
- technology components;
- process and policies;
- development plan timeline;
- program milestones; and
- forecast budget.

The FDM Plan also includes a statement of principles, a glossary of FDM terms, the user needs assessment and GDRAS selection criteria. The Plan is considered to be a living document and will be revised as required. The FDM Plan was approved by the Steering Committee and has been provided to all stakeholders and staff directly involved with the FDM program for comments and feedback.

The most significant challenge in developing the FDM Plan was forecasting timelines for GDRAS selection and acceptance. Given the high capital investment represented by a GDRAS system, it is important to allocate appropriate time and resources to the evaluation and selection process. A minimum timeline of 4 to 6 months is recommended and, if onsite trials are planned, a one year timeline is practical.

5. FDM Implementation Team

An FDM Implementation Team was struck in February of 2002 for the purposes of:

- developing FDM operating procedures;
- specifying the initial exceedence event set;
- GDRAS evaluation;
- pilot liaison;
- departmental coordination; and
- to assist in program implementation and system validation.

Membership includes the FDM Program Manager and representatives from the pilots association, Flight Operations, Flight Training, Maintenance and

Information Technology. Five line pilots are included on the Team to ensure adequate representation and feedback from the pilot group.

The FDM Implementation Team agreed on the initial drafts of WestJet's exceedence event set and FDM operating procedures in April and June respectively. Following a five month evaluation process, the Team made a recommendation on GDRAS selection in early July.

Work is ongoing for the FDM Implementation Team as the program develops and issues arise. For example, classification of the exceedence events into Class 1, 2 and 3 severity levels is continuing. Likewise, the issue of flight data as a corporate resource is being addressed through dialogue with stakeholders and WestJet's executive.

6. Stakeholder Awareness

FDM represents a major safety initiative, a powerful efficiency tool and a significant corporate investment for WestJet. There are therefore a number of stakeholders in the FDM program, including: the Flight Safety, Flight Operations, Flight Training and Maintenance departments, Dispatch, the pilot group and ultimately, the entire company. An important component of WestJet's FDM Plan is to educate stakeholders about the program, keep them informed of program developments and collect feedback on program performance.

The departments directly affected have received background material on the FDM program. Directors also received individual briefings during the user needs assessment process. The pilot group has received a dedicated memo introducing FDM and many have been contacted informally by FDM Implementation Team members. FDM has also been the subject of several Flight Safety Newsletter articles over the past year and regular updates have been provided at WestJet's quarterly flight safety committee meetings.

One pilot member of the FDM Implementation Team has agreed to act as part-time program administrator and will be tasked with establishing an ongoing stakeholder awareness program. WestJet's preference is to have a pilot coordinate the stakeholder awareness program because of its flight crews' direct involvement with FDM and the need to communicate effectively with this employee group.

In order to continue effective pilot communication, the FDM Program Manager has attended several pilot association meetings where class representatives and the association executive have been briefed on FDM principles and program development. Continuing dialogue with the pilots association and a pilot-driven

stakeholder awareness program are expected to provide the effective communication required for a successful FDM program.

7. GDRAS Selection

GDRAS selection was one of the most difficult processes in WestJet's FDM program development. GDRAS systems are complex analysis tools and are offered with a number of different options and capabilities. In order to effectively sort through the specialized features of competing GDRAS systems, WestJet retained the services of an experienced consultant to assist in the GDRAS selection process. The consultant provided liaison with GDRAS vendors and assisted in the evaluation of their competing proposals.

Generic GDRAS selection criteria were included as an appendix to the FDM Plan and cover items such as:

- system access and security;
- data de-identification;
- event validation;
- report generator;
- ad hoc queries and analyses;
- data export;
- event set modification;
- documentation;
- training; and
- pricing

Each FDM program will have to develop its own GDRAS evaluation matrix depending on needs and resources. The WestJet FDM Implementation Team used the generic criteria above, as well as considering the ease of use of each competing system, data mining capabilities and customer support record. Also considered was the total corporate investment required for each system over a five year life cycle including support, training and upgrade costs as well as other resources needed to meet stakeholders' flight data information needs.

The WestJet GDRAS evaluation process involved software demonstrations by four vendors, familiarization with one GDRAS demo system and a user survey of eight airlines with established FDM programs. Following extensive dialogue with vendors, a final evaluation by the FDM Implementation Team was made in early July. The Team's recommendation will now be taken to senior management for confirmation and authority to proceed with negotiations and acquisition of the GDRAS system.

8. The Next Steps

Over the next several months WestJet expects to proceed with:

- acquisition and installation of the GDRAS system;
- validation and acceptance of the GDRAS system;
- completion of event set classification;
- refinement of the LFL and event set;
- selection of gatekeepers;
- further development the stakeholder awareness plan;
- completion of a corporate policy on the use of flight data;
- establishment of an infrastructure for data collection;
- investigation of flight animation software systems; and
- a six month trial of the FDM process.

WestJet is firmly committed to FDM. Its people are providing the executive, management and employee support necessary for the program to succeed. WestJet's culture of cooperation and communication is also proving to be a valuable resource in facilitating program development and implementation. WestJet is looking forward to establishing FDM as an integral part of its Safety Management System as well as a valuable component of other company programs.

APPENDIX B

Joint Flight Data Monitoring Demonstration Project

Phase 2 Report

Prepared for
Transportation Development Centre
of
Transport Canada

by

WESTJET

April 2003

1. Introduction

Since WestJet issued its FDM Project Phase 1 report in July, 2002, the program has achieved several milestones, including:

- review of the FDM Plan;
- purchase and installation of FDM network hardware;
- selection, purchase, installation and acceptance of a GDRAS system;
- selection and purchase of a flight animation system;
- development, programming and basic validation of the WestJet exceedance event set;
- selection of three pilot gatekeepers;
- drafting of a flight data information security policy;
- development of a FDM stakeholder awareness plan;
- collection and analysis of an initial data set from operational flights; and
- successful completion of a FDM demonstration.

WestJet achieved the Phase 2 milestone of completing a user needs assessment in May, 2002. Details were provided in the Phase 1 report.

The WestJet FDM program continues to receive full support from the company's executive, management and pilot association. For example, the pilot association executive have been instrumental in developing a mutually agreeable set of Gatekeeper selection criteria, and for carrying out the Gatekeeper selection process.

In January, 2003, WestJet hired a full-time flight data analyst to perform programming of the exceedance event set, and manage the daily operation of the GDRAS system. Additional staff have also been assigned to the Flight Safety department, and have been tasked with implementing the stakeholder awareness plan and completion of the flight data information security policy.

WestJet is on track to begin a trial operation of the FDM program using line operations flight data in April, 2003. The target date for full program implementation is now set for November, 2003.

2. FDM Plan

WestJet's FDM Plan has been amended several times, primarily with respect to timelines and milestone completion dates. Some completion dates were amended because milestones could not be completed in the order originally planned. For example, it was impossible to specify and acquire GDRAS

hardware before confirming GDRAS selection due to the different requirements of each GDRAS system.

External events and unforeseen circumstances were other causes for timeline adjustments. For example, contract negotiations for the GDRAS system extended over a two month period, as neither party had a "boilerplate" document from which to work. Likewise, a minor installation error delayed GDRAS system acceptance for almost two months while the error was being identified and resolved.

A list of relevant milestones, their original target dates, and their revised target dates is shown below.

Milestone	***FDM Plan Timeline***	***Completion Date***
• TC memorandum of understanding signed	Jan 18 / 02	Jan 18 / 02
• FDM Statement of Principles complete	Mar 15 / 02	Aug / 02 (revised)
• security policies and procedures complete	Mar 15 / 02	Ongoing
• user needs assessment complete	Mar 31 / 02	May / 02
• operating policies and procedures complete	May 31 / 02	Ongoing
• GDRAS selection complete and contract signed	Aug 15 / 02	October / 02
• hardware acquisition and installation complete	Aug 31 / 02	November / 02
• GDRAS installation complete	Sept 30 / 02	November / 02
• initial data set collected and entered into GDRAS	Oct. 1 / 02	March / 03
• schedule & milestones for continuing operations	Nov 1 / 02	*forecast July / 03*
• system verification complete	Nov 30 / 02	March / 03
• system acceptance	Dec 15 / 02	March / 03
• begin 6 month FDM system trial	Jan 1 / 03	*forecast April / 03*

The FDM security policies and procedures milestone is labeled as "Ongoing" because WestJet is currently in the final stages of revising its corporate information security policy. FDM policies and procedures will have to be harmonized with the revised corporate policy as it is promulgated. The FDM Program Manager also expects that minor adjustments to the security policies and procedures will be required as the trial period, beginning in April, progresses. Likewise, the operating policies and procedures milestone is also labeled as "Ongoing," as minor adjustments to the program's operation are expected during the trial period.

3. GDRAS System

WestJet has selected the ***AGS*** GDRAS system produced by ***SFIM, Inc.***, a subsidiary of the French telecommunication and defense firm ***SAGEM***. The AGS system best meets WestJet's GDRAS needs and provides a high degree of functionality, flexibility and ease of use.

WestJet's GDRAS selection process is described in the FDM Project Phase 1 report. Our comprehensive GDRAS evaluation was completed in August, 2002 with management approval of the FDM implementation team's recommendation. Direct negotiations with SFIM, Inc. were undertaken in August, 2002, and a letter of intent was issued by WestJet on September 13, 2002. Because an appropriate "boilerplate" software licensing agreement was not available from either party, a final agreement to acquire the AGS system was not completed and signed until November 1, 2002.

Once the final licensing agreement was substantially complete, WestJet placed an order for hardware to meet the AGS system requirements. All hardware was delivered to SFIM, Inc. in Grand Paririe, TX for software loading and configuration. Installation and final system setup at WestJet's Calgary operations centre was completed by SFIM, Inc. on November 21, 2002.

Substantial acceptance of the GDRAS system was complete by the end of November, 2002. Final acceptance was delayed until February, 2003 by mutual agreement, as a new version of the software was scheduled to be released in January, 2003. Following installation of the new version of AGS, a setup anomaly also had to be traced and corrected before WestJet completed its final acceptance.

WestJet used a comprehensive set of acceptance criteria, covering all functional and maintenance aspects of the GDRAS software. We strongly recommend that any GDRAS purchaser employ a similar acceptance process in order to ensure

that all expected functionality is available from the installed system. A copy of WestJet's acceptance criteria is attached as Appendix 1.

WestJet's FDM Program Manager and FDM Analyst undertook AGS training in February, 2003. The Program Manager completed the basic user's course while the FDM Analyst completed an additional programmer's module. Both users report that the system is easy to use and that it meets or exceeds the expected level of functionality in all areas.

4. Flight Animation System

WestJet's decision to acquire a flight animation system as an integral component of the FDM program was first identified in our FDM Plan, published in September, 2001. The flight animation system is seen as a valuable tool in event analysis, flight safety investigations, and stakeholder communication programs. This resource will permit the Event Review Team to undertake rapid and intuitive analyses of selected events by bringing multiple data streams together in the animation of aircraft flight path and flight instruments. Future applications of the flight animation system may include flight crew airport familiarization, and pre-briefing and de-briefing for flight simulator training.

The flight animation system selection process began in July, 2002 with a review of products and vendors. Four potentially suitable products were identified, and each vendor was invited to present a demonstration of their product to WestJet's FDM implementation team. Following completion of these demonstrations, the team undertook a detailed analysis of each product's features, functionality and cost. Because of the complexity of flight animation systems, supplemental questions were sent to each vendor to ensure that the selection team had an accurate understanding of each product.

In November, 2002, the FDM selection team made a recommendation to purchase the ***INSIGHT*** flight animation suite produced by ***Flightscape, Inc.*** of Ottawa, ON. INSIGHT was found to be the best fit for WestJet's animation needs, and the selection team found a high degree of value in the package offered by Flightscape, which included: development of accurate flight and navigation instrument displays, inclusion of a selected number of high definition airport geographic environments, free distribution of the INSIGHT viewer, and provisions to integrate the INSIGHT system with WestJet's full flight simulators.

A software license agreement between WestJet and Flightscape was concluded and signed in December, 2002. Product delivery is scheduled for May, 2003, with user training to be completed shortly thereafter.

5. WestJet's Exceedance Event Set

WestJet has developed a unique exceedance event set for the AGS system which identifies occurrences where specific operating limits or procedures have not been met. Event limits, or trigger values, have been set with respect to aircraft limitations, WestJet's standard operating procedures, and normal aircraft operating techniques. Events are classified by type (eg. SPEED, ATTITUDE, etc.) and severity. Three event severity classifications have been established, with Class 3 events posing the most serious risk to flight operations.

Events can be simple exceedances of set values, or the coincidental occurrence of a series of related parameter values. For example, a flap overspeed is a single parameter limit exceedance, while a low energy approach is the coincidental occurrence of a number of parameter limit exceedances (eg. airspeed, height above aerodrome and engine power setting).

The WestJet exceedance event set includes 118 events, and was developed by the FDM implementation team using input from a number of sources, including:

- the FAA / UTRS generic event set;
- the AGS Boeing 737NG event set;
- Delta Airlines' Boeing 737NG event set;
- the pre-programmed FDAMS (onboard flight data acquisition and management system) event set; and
- the implementation team's combined operational experience.

Event definitions are entered into AGS using the SFIM / SAGEM programming language. Complete programming, testing and validation of the event set has taken approximately three months. Some events took extra effort to program because a number of AGS parameter names do not correspond to the parameter names provided by Boeing in its B737NG data frame. Another challenge was to accurately convert some raw data measurements (for example, flap lever position) into engineering units for use in the AGS analysis.

During a six month trial period commencing in April, 2003, WestJet will test our event set under operational conditions. Minor adjustments in trigger values and re-working of event definitions or programming will be made as required in order to provide consistent, reliable results in exceedance event reports. Another task to be undertaken by the Event Review Team during this period, will be to ensure that the event severity classifications are appropriate.

6. Gatekeeper Selection

Gatekeepers are selected pilot representatives who are tasked with contacting flight crews when additional information about a recorded exceedance event is required. In order to preserve pilot confidentiality, access to pilot identities is limited to WestJet's three Gatekeepers and the FDM Program Manager. All Gatekeeper pilot contacts are made in strict confidence.

The Gatekeeper positions are critical to the success of the FDM program because it is important to ensure that only valid exceedance events are recorded in the FDM database. For example an approach at Vref + 20 knots may at first appear to be a valid exceedance event (High Airspeed on Approach). However, if a Gatekeeper / pilot interview reveals that the surface wind was 20 knots, gusting to 30 knots, then the recorded approach speed is entirely within operating limits and the event should be removed from the database.

Gatekeepers must be respected members of the pilot group, possess good communication skills, and be able to approach pilots in a non-threatening manner. Development of the Gatekeeper selection criteria was a joint effort between WestJet's Flight Operations management team, the FDM Program Manager and the pilots association. Selection of the three Gatekeepers was carried out entirely by the pilots association executive.

Gatekeepers will receive instruction in interview techniques before commencing pilot contacts. Their sole purpose is to obtain information about exceedance events, and they must be able to convey that message to pilots in a manner which encourages open and honest communication. Pilot contacts are expected to begin once the WestJet exceedance event set has been fully tested during the six month trial period beginning in April, 2003.

7. Flight Data Information Security Policy

WestJet recognizes that flight data is a valuable corporate resource, and can benefit the organization in many ways. The FDM program will therefore provide de-identified, aggregate information to specific departments when requests are approved by the FDM Program Manager.

During the course of normal operations, selected raw data are also disseminated to several departments independent of the FDM program. For example, engine parameters are monitored in real-time, and other aircraft parameters are recorded and analysed by the Maintenance department as part of WestJet's Aircraft Condition Monitoring System (ACMS).

In order to ensure pilot confidentiality, and prevent inappropriate use of flight data, WestJet is developing a Flight Data Information Security Policy. The policy is consistent with WestJet's new corporate information security policy, and specifies flight data ownership, availability, confidentiality, and consequences for non-compliance with the policy. Consequences may include discipline up to and including dismissal.

Promulgation of the Flight Data Information Security Policy to the pilot group and to other stakeholders is a key element of the FDM communication plan.

8. FDM Communication Plan

WestJet has developed an FDM communication plan to establish and maintain stakeholder awareness of the FDM project and to facilitate feedback from those associated with FDM activities. The FDM communication plan has four objectives:

- to promote an understanding of the goals and functions of the FDM program;
- to increase the comfort level of flight crews;
- to provide ongoing awareness of FDM activities; and
- to facilitate feedback from stakeholders

Although a general introduction to FDM was provided to all pilots in early 2002, and FDM has been the subject of several flight safety newsletter articles, there still remains some confusion over the goals and structure of the program. One member of the Flight Safety department staff has therefore been tasked with implementing the FDM communication plan as a priority item. We anticipate that a dedicated, systematic approach to this task will increase awareness and understanding of the program and enhance its overall success.

The first phase of the communication plan will consist of providing a general FDM program description to all stakeholders, along with copies of FDM procedures, the exceedance event set and sample program outputs. Printed material, electronic notices and a series of information meetings, will be used to communicate this information.

Subsequent phases will involve further distribution of program information via newsletter and electronic notices, and will include monthly or quarterly reports on FDM outcomes. Gatekeepers and members of the Event Review Team will also be encouraged to provide information on a personal basis to any member of the company with an interest or question about the program.

9. Initial Data Set

Two sample data sets, recorded in April and June of 2002, have been used by the FDM program during AGS system trials and event set programming. Each data set was obtained from PCMCIA cards containing flight data from normal line operations.

In early April, 2003, a current data set was obtained to test the AGS programming, which was substantially complete at that time. All expected flight data were present, without data dropouts or gaps. Tabular and graphical analyses were performed successfully, and events were identified and displayed as expected.

10. FDM Demonstration

On March 27, 2003, WestJet demonstrated both the ***AGS*** and ***INSIGHT*** systems to representatives from Transport Canada Civil Aviation and the Transportation Development Centre. The presentation included a program history, screenshots from the various analysis tools, and live demonstrations of both software packages. Several excerpts are presented below.

Figure B-1 – Test Event Set Analysis

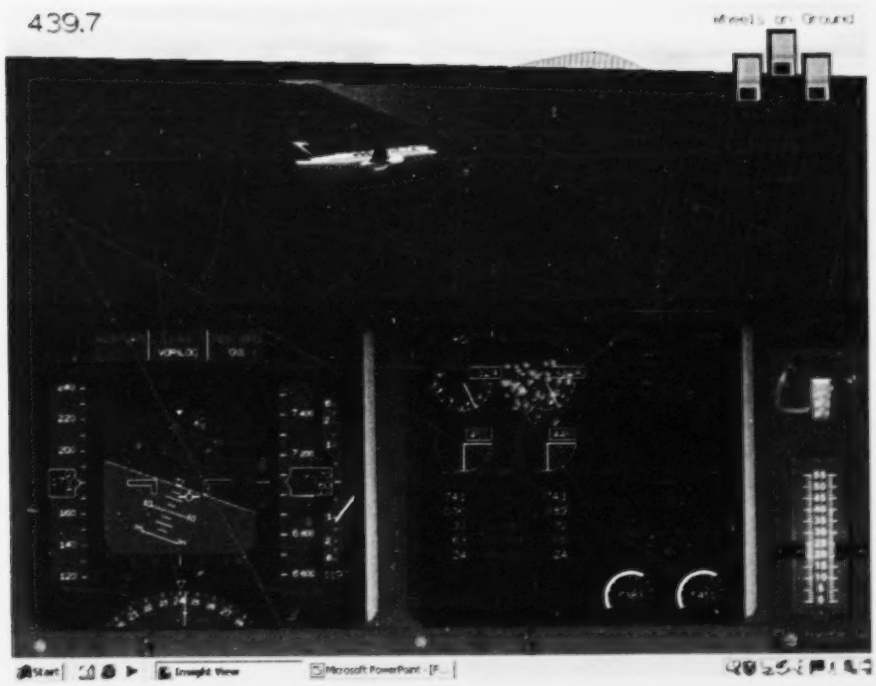

Figure B-2 – Sample INSIGHT Flight Animation

10. The Next Steps

The FDM system will enter a six month test phase in April, 2003 where flight data will be input and analysed on an ongoing basis. During this trial period, steady-state operations will be evaluated, event definitions and/or trigger limits adjusted as necessary, statistical reports will be developed, and operating policies and procedures amended as required. The trail period will also provide an opportunity for members of the Event Review Team to become familiar with the system and their role within the FDM program.

This trial period will also see implementation of the FDM communication plan. Information will be disseminated via hard copy and electronic formats, as well as through individual and group briefings, and feedback channels will be established with all stakeholders. WestJet anticipates "going live" with our FDM program before the end of 2003.

Figure B-2 – Sample INSIGHT Flight Animation

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Appendix 1 – GDRAS Acceptance Checklist

#	DESCRIPTION	*START Time / Date*	*END Time / Date*	*SIGNOFF BY*
	System Configuration.			
	Initial installation of hardware, operating system and application - on the server, is complete			
	Initial installation of hardware, operating system and application - on the workstations, is complete			
	Application availability and functionality over the LAN is complete and fully operational.			
	Application availability and functionality over the WAN is complete and fully operational.			
	Application support availability (1-800 remote link function) and functionality over the WAN is complete and fully operational.			
	Data & Media			
	Data media and device compatibility test for accurate handling of information flow.			
	Data encryption validation test.			
	Data compression validation test.			
	Invalid recorded data (corrupt data) handling test. Verify media diagnostic tools to identify, correct, where possible and associate source info for corrective action demonstrated.			
	Remote data transmission / receipt functionality test.			
	Processing benchmark tests are run and conform to documented expectations of the application.			
	Specifying users and associated privileges			
	Method of assigning user privileges is functional			
	Method of system password protection is functional			
	Provides an audit trail to track changes in users and their level of access.			
	Assignment of system, network and database administrator is consistent with security policy			
	Initial Analysis and reporting capability is tested and fully functional.			
	Trial data set integration functions accepted			
	Data entry works			
	Data analysis works			
	Trend Validation Reports – operational			
	Historic flight data, simulated handling and proof of functionality			

#	DESCRIPTION	*START Time / Date*	*END Time / Date*	*SIGNOFF BY*
	System BACKUP Functionality			
	Verify the tools to complete a System Backup are fully operational			
	Verify the tools to complete a System Restore are fully operational			
	FDM Data Backup functionality proven to be fully operational			
	FDM Data Restore functionality proven to be fully operational			
	Backup and Archive			
	Verify the tools to complete Archiving of Data are fully operational			
	Verify the tools to complete an Archive Recall and Reload of the Data into the database are fully operational and functional. Restart the database to verify data integrity.			
	Removing data after retention period is exceeded			
	Authorized users can remove data to archiving location.			
	Authorized users can return data from archiving to live database.			
	Data de-identification and security mechanism			
	Automatic data de-identify processes as required to specification.			
	Date de-identification is permanent – i.e. – flight # and date overwritten.			
	Automatic data de-identification is user configurable			
	The Gatekeeper can override automatic de-identification.			
	The Gatekeeper can readily access identified data when necessary.			
	Attempts to gain unauthorized access to identified data are disallowed, logged and reportable			
	Procedures for LFLs			
	Verify that LFLs can be imported in electronic format.			
	Verify that multiple LFLs can be specified within the fleet			
	Event library			
	Validate the detailed documentation provided for the event sets.			
	Verify flight phases for events are defined and operational.			
	Verify triggering points for events are defined and operational			
	Verify the events in the furnished event sets are acceptable analysis criteria.			

#	DESCRIPTION	*START Time / Date*	*END Time / Date*	*SIGNOFF BY*
	Defining new and modifying existing events			
	Verify the tools are provided for event set generation.			
	Verify the presence of algorithms and formula to assist in event creation.			
	Event tools of a more complex nature are present and functional.			
	Verify that multi-levels of event severity can be defined.			
	Verify that complex relationships are supported (beyond relational operators or parameters)			
	Verify the editing tools used to modify events or trigger limits.			
	Demonstrate the existence of an audit trail for event modifications			
	Determining validity of event handling process			
	Verify functionality of application tools for locating a specific event and flight.			
	Demonstrate recovery and use of full flight (de-identified) data from storage in event analysis.			
	Demonstrate a snapshot data storage retrieval event.			
	Demonstrate multi parameter simultaneous viewing during event analysis.			
	Demonstrated user selected parameters display usage and results in event analysis.			
	Verify the ability to identify and remove invalid events from a data set.			
	Demonstrate the audit trail resulting from the removed event.			
	Routine Operational Measurements			
	Verify that Routine Operational Measurement (ROM) custom queries can be created.			
	Generating summary reports and graphs			
	Verify the standard report suite is fully operational.			
	Verify the ability to provide aggregate capabilities such as – count, minimum, maximum, mean, and standard deviation are provided.			
	Verify ability to group events by type, phase of flight location and time frame.			
	Normalization is supported as in – events per 100 flight hours, per 100 departures / arrivals or similar parameters as available within the limited available data.			
	Verify access to the database and the ability to facilitate ad hoc analyses.			
	Verify graphing and charting capabilities are functional.			

#	DESCRIPTION	START Time / Date	END Time / Date	SIGNOFF BY
	Exporting data			
	Verify data can be exported to MS Office for offline management reporting, by authorized users.			
	Documentation and Help			
	Documentation on system configuration is complete and up-to-date.			
	Verify the system user documentation is provided as required.			
	Verify the documentation set is comprehensive and complete in acceptable format and binding.			
	Verify the existence of the on-line documentation set is comprehensive, complete and in acceptable format.			
	Verify the on-line help is operational, comprehensive, complete and in acceptable format.			
	Training			
	Ensure the system startup process facilitates a reasonable degree of system administrator training opportunity.			
	Verification process of system build complete			
	Verification process of application functionality complete			
	Acceptance testing of system complete			